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On the Geographical Distribution of Anomuran and Brachyuran Crabs in Korean Waters

Kim, Hoon Soo
(Department of Zoology, College of Natural Sciences, Seoul National University, Seoul, 151 Republic of Korea)

韓國海域에 있어서 집게類와 게類의 地理的 分布에 관하여

金 熏 洙
(서울大學校 自然科學大學 動物學科)

摘　　要

한국 해역에서 알려진 집게류는 12과 57종, 게류는 20과 183종이다. 집게류에서는 집게과(Paguridae) (19종)와 넓적왼손집게 과(Diogenidae) (12종)의 종들이 많고 게류에서는 물맞이게 과(Maidae) (33종)의 종이 가장 많고 다음이 바위게 과(Grapsidae) (29종), 부채게 과(Xanthidae) (22종), 꽃게 과(Portunidae) (16종), 달랑게 과(Ocypodidae) (16종)의 순이다.

저자는 한국 해역을 동해, 대한해협, 제주도해역, 황해의 4구역으로 나누고, 집게류와 게류를 北方型, 温帶型, 南方型의 3分布型으로 나누었다. 집게류의 경우 북방형 9종, 온대형 40종, 남방형 8종이고, 게류의 경우 북방형 7종, 온대형 87종, 남방형 89종이다. 집게류의 경우 동해에 29종, 대한해협에 30종, 제주도해역에 30종, 황해에 21종이, 게류의 경우 위의 순서대로 62종, 121종, 104종, 74종이 분포하며, 각 해역에서의 분포형도 고찰했다. 각 해역에만 분포하는 종의 수는 집게의 경우 동해에 8종, 대한해협에 3종, 제주도해역에 16종, 황해에 0종, 게류의 경우 위의 순서로 8종, 20종, 40종, 12종이다. 집게류는 북방형종이, 게류는 남방형종이 비교적 많으며 동해에는 북방형종들이 제주도에는 남방형종들이 비교적 많다.

4구역 중 2구역(6조합) 사이의 類似系數($r=a/a+b+c$)를 계산한 바 양 분류군 모두 대한해협과 황해 사이의 유사성이 가장 크고 (집게류 : 0.55, 게류 : 0.59), 제주도해역과 황해 사이의 유사성이 가장 적다(집게류 : 0.20, 게류 : 0.19).

분포상을 이해하기 위하여 각 해역의 환경조건도 알아보았는 바, 분포의 양상이 해황과 잘 부합된다.

Key words: Zoogeography, Anomura and Brachyura, Korea.

INTRODUCTION

Korea is located between latitude 33°N and latitude 44°N in the Far East. The Korea peninsula is elongated from north to south, being surrounded by the sea on three sides: the Japan Sea (or East Sea), the Korea Strait and the Yellow Sea. There are many large and small islands in the southern part of the Yellow Sea side and in the Korea Strait side, of which Cheju Island, the largest island in Korea, is located at the southwestern end of Korea and quite far from the mainland. The coastal and offshore enviromental conditions in the Japan Sea, the Korea Strait, the Yellow Sea and Cheju I. waters are quite different one another. Korean waters therefore are very interesting in the viewpoint of marine zoogeography.

Since Miers (1879) recorded 5 anomuran species and 3 brachyuran species from Korean waters in his report, the data of Korean anomuran and brachyuran carbs have been accumulated.

On the geographical distribution of Korean anomurans, Kamita (1958) mentioned about that of 29 species in 7 families, Kim (1964) discussed that of 37 species in 7 families and Kim (1973) did that of 45 species in 8 families. On the Korean brachyurans Kamita (1941) discussed the distribution of 122 species or subspecies in 16 families, Kim (1972) did that of 148 species or subspecies in 17 families, Kim (1973) did that of 168 species or subspecies in 18 families and Kim and Kim (1982) did that of 175 species in 18 families. All of the above authors except Kim and Kim (1982) divided Korean waters into 3 regions [the East Sea (Japan Sea), the Korea Strait and the Yellow Sea] according to the general geographical usage. On the other hand Kim and Kim (1982) separated Cheju I. waters from the Korea Strait from the zoogeographical point of view and recognized 4 regions. On the anomuran crabs Kim (1964, 1973) divided them into northern form, temperate zone form, southern form and cosmopolitan form. In the case of the brachyuran crabs Kim (1964, 1973) and Kim and Kim (1982) recognized the above three forms with the exception of cosmopolitan form.

Thereafter new data of additional species and localities have been accumulated. Some known species of the both taxa were recognized as new species or as another different known species. In the present paper I will discuss the geographiccal distributions of anomurans and brachyurans separately and then make a comparison between them.

MATERIALS AND METHODS

Materials

The materials of the present study consist of literature records of Korean species of anomuran and brachyuran crabs in the following. Kim (1973) brought together all the species of those two taxa known by that time to issue a monograph of them, in which he gave all particulars on the investigation history of them in Korea. Since then, in the case of anomurans Kim and Choe (1976) described 4 species new to Korean fauna; Oh (1983) described 8 species from Cheju I. waters, of which 3 species were unrecorded ones in Korea by that time; and Kim (1985) described 5 unrecorded species in his paper. In the case of brachyurans, Kim and Kim (1982) added numerous new localities of many species and recorded 6 unrecorded species in their paper; Kim (1985) made the collection list of 66 brachyuran species found throughout Korean waters, of which 5 unrecorded species by that time were described; and Kim and Chang (1985) recorded 104 brachyuran species of Cheju Island based

upon the literature records and new additional materials, of which 3 species were described as the unreported species in Korea by that time. Besides those literatures Kim (1973a), Kim and Lee (1978), Kim *et al.* (1979), Kim, Lee and Kim (1979), Kim *et al.* (1981), Kim and Choe (1981), Choe and Kwon (1982), Kim and Kwon (1982), Kim *et al.* (1983), Lee *et al.* (1984), Lee *et al.* (1985) and Kim and Kim (1985) included anomuran and brachyuran species in their local survey reports.

Of anomuran species appeared in Kim's book (1973) *Paguristes barbatus, Pagurus samuelis* and *Lophomastix brevirostris* should be changed to *Paguristes ortmanni* Miyake, 1978, *Pagurus geminus* McLaughlin, 1976, and *Lophomastix japonica* (Duruflé, 1889) (cited from Miyake, 1982) respectively, and these facts were already reflected in Kim's paper (1985). Of brachyuran species appeared in Kim and Kim's paper (1982) *Actaea savignyi* and *Parapanope euagora* should be changed to *Actaea semblatae* Guinot, 1976 and *Parapanope* sp. Guinot, 1985 respectively.

Methods

At first, I made distribution tables of all anomuran and brachyuran species appeared in the literatures mentioned above. In the tables, which are not presented here, the Korean waters were divdied into 4 regions: the Japan Sea, the Korea Strait, the Cheju Island waters and the Yellow Sea, and distributional form is divided into 3 forms: northern form, temperate zone form and southern form. Northern form means the dwellers which live not only in Korean waters but also in cold regions such as Kamchatka and Alaska, temperate zone form means the Far East endemic ones living in waters of Korea, Japan and midle and north China, and southern form means the ones living also in the tropical Indo-West Pacific regions. The tables also included columns of Japan, China and others in order to refer them for judging distributional form of each species. For distribution of each species I also refer to Sakai's book (1976) and Miyake's books (1982, 1983). Based upon the tables, I prepared tables showing anomuran and brachyuran families and species number of each family to catch outline of their faunas. I also prepared 4 tables to analize distributional status of them in several viewpoints. To consider similarity of species composition between two of four regions, I calculated Jaccard's coefficient, $a/(a+b+c)$ (Pielou, 1979: 25).

Results and Discussion

For understanding the distribution of anomuran and brachyuran crabs in Korea, environmental conditions of surrounding seas of Korea should be mentioned briefly.

The Korea peninsula is under the influence of the Tsushima Warm Current, a large branch of the Kuroshio, and the North Korea Cold Current. A branch of the former, known as the East Korea Warm Current, flows along Tsushima until it mixes with deep water which flows southwards in the neighborhood of Chukpyŏn, Kangwon-do Province, Korea. This branch flows gradually eastwards, and Ullŭng-do Island is influenced much by this current. Although the East Korea Warm Current sometimes reaches the coast of Hamkyongbuk-do Province, North Korea, its northern limit is, in general, off Chumunjin or the area between Chukpyŏn and Ullŭng-do I. The North Korea Cold Current flows southwards along the coast of North Korea until it reaches the southern part of Kangwŏn-do Province. It however sinks gradually around the coast of Kyŏngsangbuk-do Province. Another branch of the Kuroshio tends to flow off the cast of Cheju I. and through the Yellow Sea. However, this current is weak in this Sea (Fig. 1) (Kang, 1966).

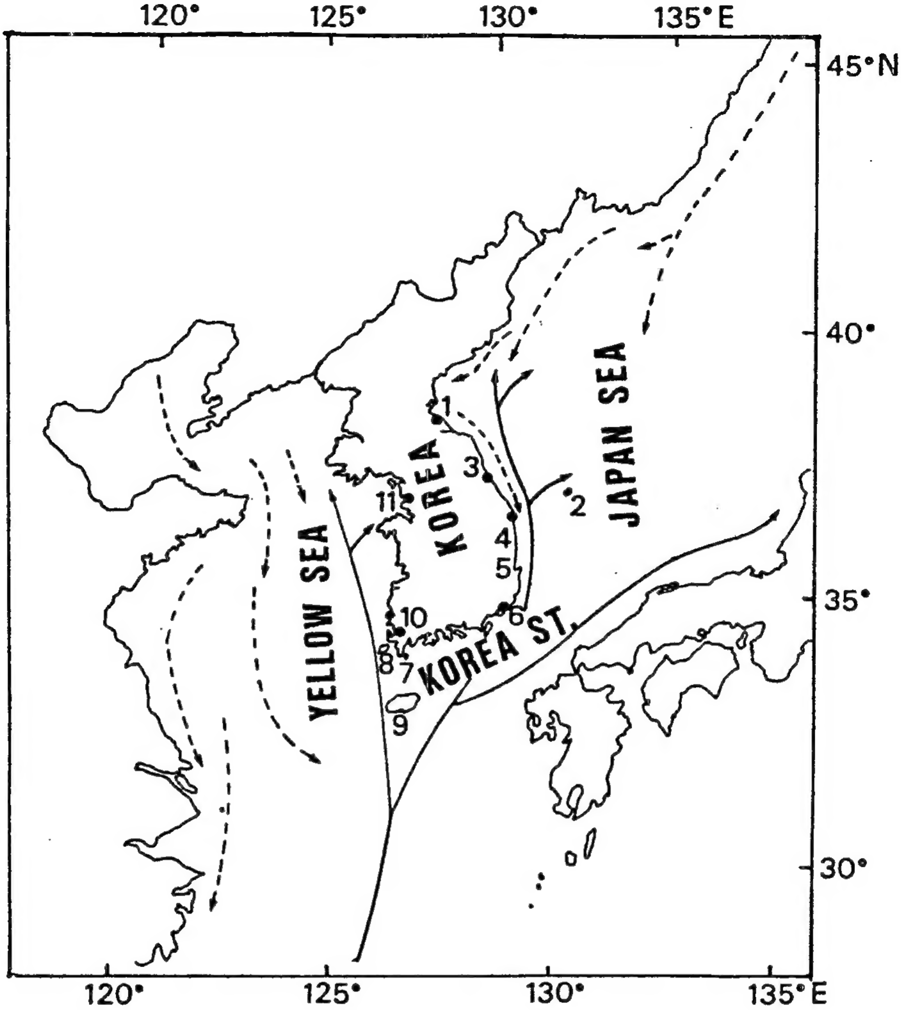

Fig. 1. Surface currents in the surrounding seas of Korea, and the locations appearing in the text and Table 1.
— surface currents of warm water in summer.
--- surface currents of cold water in winter.
1. Wonsan 2. Ullung-do I. 3. Chumujin 4. Chukpyŏn 5. Yŏngil Bay 6. Pusan 7. Wan-do I. 8. Jin-do I. 9. Cheju-do I. 10. Mokpo 11. Inchon

Average depths of the Japan Sea, the Korea Strait and the Yellow Sea are 1,684m, 101m and 44m respectively. The maximum tide ranges are highest in the Yellow Sea (e.g. 9.5m at Inchŏn), very small in the Japan Sea (e.g. 0.2m at Yŏngil Bay) and the ranges in Korea Strait are smaller than in the Yellow Sea. The major rivers of Korea flow into the Yellow Sea. There are vast muddy intertidal zones in the Yellow Sea side for its shallow depth and large tide range. On the other hand the east coasts (Japan Sea side) are rocky or sandy. The Korea Strait seems to have somewhat medial features of the Yellow Sea and the Japan Sea side in several points (see Table 1).

The coastal surface water temperatures are highest in the Cheju I. waters and next in the Korea

Table 1. Environmental conditions of the surrounding seas of Korea (1).

Seas	Average depth	Maximum Tide range	Turbidity	Coastal bottom
Japan Sea	1,684 m	0.2 m (Yŏngil B.) 0.6 m (Wŏnsan)	Clear	Rocky Sandy
Korea Strait	101 m	1.4 m (Pusan) 3.9 m (Wan-do)	Medium	Rocky Muddy Sandy
Cheju I. waters		2.4 m	Somewhat clear	Rocky Sandy
Yellow Sea	44 m	4.1 m (Mokpo) 9.5 m (Inchŏn)	Muddy	Muddy Sandy Rocky

Table 2. Environmental conditions of the surrounding seas of Korea (2).

Seas	Coastal surface water temperature		
	Minimum*	Maximum*	Annual average
Japan Sea	-1.3— 8.2°C	19.2—23.0°C	8—16°C (Coastal sea) 9—17°C (Offshore)
Korea Strait	5.1—10.4°C	20.1—25.4°C	16—19°C (Coastal sea) 19—20°C (Offshore)
Cheju I. waters	12.0—13.9°C	25.3—25.8°C	17.7—18.7°C (Coastal sea)
Yellow Sea	0.6—3.3°C	21.3—26.0°C	11—15°C (Coastal sea) 12—15°C (Offshore)

(Cited from Gong, 1968), *Monthly average

Strait. The range of water temperature is largest in the Japan Sea side and the next-to-largest in the Yellow Sea (see Table 2). The salinity in the Yellow Sea (around 32.0‰ in February, around 31.0‰ in August) is lower than in the Korea Strait and the Japan Sea (around 34.2‰ in February, around 33.0‰ in August).

As shown in Table 3, the total anomuran species found in Korean waters are 57 species which are distributed among 12 families. Of these the Paguridae is the largest family which includes 19 species. This family is followed by Diogenidae (12 species), Porcellanidae (7 spp.), Lithodidae (6 spp.), Galatheidae (4 spp.) and so on.

The high representation of Korean species in families Diogenidae and Paguridae seems to be

Table 3. Anomuran families and numbers of their species or subspecies.

Superfamilies	Families	No. of sp.
Thalassinoidea	Axiidae	1
	Laomediidae	1
	Callianassidae	1
	Upogebidae	1
Coenobitoidea	Pomatochelidae	1
	Diogenidae	12
Paguroidea	Paguridae	19
	Lithodidae	6
Galathoidea	Chirostylidae	2
	Galatheidae	4
	Porcellanidae	7
Hippoidea	Albuneidae	2
	12 fam.	57 sp.

Table 4. Brachyuran families and numbers of their species or subspecies

Sections	Families	No. of sp.
Dromiacea	Dromiidae	6
Archaeobrachyura	Tymolidae	1
	Latreillidae	2
	Raninidae	2
Oxystomata	Dorippidae	2
	Calappidae	9
	Leucosiidae	12
Oxyrhyncha	Majidae	33
	Hymenosomatidae	5
	Parthenopidae	4
Cancridea	Atelecyclidae	4
	Cancridae	3
	Corystidae	1
Brachyrhyncha	Portunidae	16
	Goneplacidae	5
	Hexapodidae	1
	Xanthidae	22
	Grapsidae	29
	Pinnotheridae	10
	Ocypodidae	16
	20 fam.	183 sp.

typical. For example, in the case of Japanese anomuran species, 322 species or subspecies of 16 families, Galatheidae, Diogenidae and Paguridae are the large families and include 60, 50 and 51 species respectively (Miyke, 1982). The Korean Galatheid species are only 4. This small number may be due to the lack of deep and warm water area.

As shown in Table 4, the total brachyuran species known from Korean waters are 183 species (or subspecies) of 20 families. Of these the largest one is Majidae which includes 33 species (or subspecies). This family is followed by Grapsidae (29 spp.), Xanthidae (22 spp.), Portunidae (16 spp.), Ocypodidae (16 spp.), Leucosiidae (12 spp.), Pinnotheridae (10 spp.). Each of remaining 13 families includes one to nine species.

According to Miyake (1983), in the case of Japanese brachyuran species, 957 species or subspecies of 34 families, Xanthidae (242 spp.), Majidae (142 spp.), Portunidae (88 spp.), Leucosiidae (79 spp.) and Grapsidae (63 spp.) are the large families. In comparison with these, the above five families are also large in Korean waters, and Korean Grapsidae, Ocypodidae and Pinnotheridae show relatively high representation of species. The grapsid species dwell in rocky, stony, sandy—muddy supra-, inter- or subtidal zones; the ocypodid species are hole dwellers in sandy—muddy intertidal zones; and the pinnotherid species live in bivalve molluscan species which are abundant in sandy—muddy inter- or subtidal zones. The coastal zones of the Yellow Sea and the Korea Strait have vast area of such suitable habitats for these animals. This may be the reason why the Korean Grapsidae, Ocypodidae and Pinnotheridae show relatively high representation of species.

Table 5 was made to analize the species composition of Korean anomurans and brachyurans categorized by distribution forms. In the case of the former, temperate zone form species (70.2% of 57 species) are overwhelmingly numerous, and the ratio of the northern form species is almost the same as the one of the southen form species and remarkably high as compared with brachyurans. In the case of the brachyurans, the number of the southern form species exceeds a little the temperate zone form species and the number of northern form species is only 7 (3.8%). The ratio of the southern form species (48.6%) is greatly high as compared with anomurans.

Table 6 was made to analize the occurrence ot anomuran and brachyuran species categorized by regions and distribution forms. In anomuran case, 29, 30, 30 and 21 species occurred in the Japan Sea, the Korea Strait, the Cheju I. waters and the Yellow Sea respectively. The least number ot species was found in the Yellow Sea. Each of 4 reagions has the greatest number of the temperate zone form species. The greatest number of the northern form species (9 species) and the least number of the southern form species (1 species) occurred in the Japan Sea. In contrast with this, the greatest number of the southern form species (6 species) and none of the norhtern form species were found in the Cheju I. waters. In brachyuran case, 62, 121, 104 and 74 species occurred in the Japan Sea, the Korea Strait, the Cheju I. waters and the Yellow Sea respectively. The least number of

Table 5. Numbers of species or subspecies of Anomura (A) and Brachyura (B) categorized by distribution forms.

	N	T	S	Total
A	9(15.8%)	40(70.2%)	8(14.0%)	57
B	7(3.8%)	87(47.6%)	89(48.6%)	183

N: Northern form T: Temperate zone form S: Southern form

species was found in the Japan Sea and the greatest number in the Korea Strait. Each of 4 regions except the Cheju I. waters has the greatest number of temperate zone form species. The highest ratio (11.3%) of the northern form species appears in the Japan Sea, that (62.1%) of the temperate zone form species does in the Yellow Sea and that (61.5%) of the southern form species does in the Cheju I. waters.

Table 7 was prepared to catch the species which occurred in only any one of 4 regions and the ones occurring in all regions, and to analize the species composition by the distribution forms. In anomuran case, 8 species (27.6% = 8/29, 14.0% = 8/57) occurred in only the Japan Sea, where the northern form species are predominated in species number and none of the southern form species; 3 species (10.1% = 3/30, 5.3% = 3/57) occurred in only the Korea Strait, where none of the northern form species; 16 species (53,3% = 16/30, 28.1% = 16/57) appeared in only the Cheju I. waters, where we can see the highest number of the tempėrate zone form species (including Korean endemic

Table 6. Numbers of species or subspecies categorized by regions and distribution forms.

		N	T	S	Total
Anomura	JS	9(31.0%)	19(65.5%)	1(3.5%)	29
	KS	2(6.7%)	24(80.0%)	4(13.3%)	30
	CI	0	24(80.0%)	6(20.0%)	30
	YS	2(9.5%)	17(81.0%)	2(9.5%)	21
Brachyura	JS	7(11.3%)	32(51.6%)	23(37.1%)	62
	KS	1(0.8%)	66(54.6%)	54(44.6%)	121
	CI	1(0.1%)	39(37.5%)	64(61.5%)	104
	YS	1(1.4%)	46(62.1%)	27(36.5%)	74

JS: Japan Sea KS: Korea Strait
CI: Cheju I. waters YS: Yellow Sea

Table 7. Numbers of species or subspecies occurring in only any one of 4 regions and all regions (A) categorized by distribution forms.

		N	T	S	Total
Anomura	JS	6	2	0	8(27.6% = 8/ 29)
	KS	0	2	1	3(10.0% = 3/ 30)
	CI	0	12	4	16(53.3% = 16/ 30)
	YS	0	0	0	0
	A	0	6	1	7(12.3% = 7/ 57)
Brachyura	JS	6	1	1	8(12.9% = 8/ 62)
	KS	0	14	6	20(16.5% = 20/121)
	CI	0	10	30	40(38.5% = 40/104)
	YS	0	9	3	12(16.2% = 12/ 74)
	A	1	14	8	23(12.6% = 23/183)

species, *Uroptychus zezuensis* Kim), comparatively high number of southern form species and none of northern form species; none of anomuran species occurred in only the Yellow Sea; 7 species (12.3% = 7/57) were found in all 4 regions, where the temperate zone form species are predominated.

In the case of brachyuran crabs, 8 species (12.9% = 8/62, 4.4% = 8/183) occurred in only the Japan Sea, where the northern form species are predominated as in anomuran case; 20 species (16.5% = 20/121, 10.9% = 20/183) occurred in only the Korea Strait, where the temperate zone species (including Korea endemic species, *Sakaina koreensis* Kim & Sakai) are predominate, relatively many southern form species are seen and none of northern form species; 40 species (38.5% = 40/104, 21.9% = 40/183) occurred in only the Cheju I. waters, where the southern form species are remarkably predominated differently in the anomuran case, 10 temperate zone species (including Korea endemic species, *Actumnus marssinicus* Takeda & Kim) are seen, and none of northern form species; 12 species (16.2% = 12/74, 6.6% = 12/183) occurred in only the Yellow Sea, where 9 temperate zone species (including 7 Yellow Sea endemic species: *Orithyia sinica, Parapanope* sp., *Eriocheir sinensis, E. leptognathus, Pinnotheres tsingtaoensis, Scopimera bitympana* and *Ilyoplax pingi*) occurred, 3 southern form species also appeared, and none of northern form species; 23 species (12.6% = 23/183) were found in all 4 regions (this percentage is almost same as in anomuran case), where the temperate zone form species are predominated and southern form species are numerous in comparison with anomurans.

As mentioned above, in the both cases of Anomura and Brachyura,the most of the northern form species occur in the Japan Sea side whilst the most of the southern form species occur in the Cheju Island waters. Six of 8 anomuran species which occur in only the Japan Sea are the northern form species, of which 5 species are deep water species, and 30 of 40 brachyuran species which occur in only Cheju Island waters are the southern form species. These facts seem to coincide well with the situations that northern part of the Japan Sea side is influenced strongly by the North Korea Cold Current and accordingly its water temperature is lowest among four regions; and the Cheju Island waters are influenced most strongly by the Tsushima Warm Current and accordingly its water temperature is highest. On the other hand, in general shallow water species and hole dwelling species in intertidal zones are dominated in the Yellow Sea, and 7 of 9 temperate zone form species which occur in only the Yellow Sea are endemic species of the sea. These ditributional situations seem to be correlated with the oceanographic conditions of the sea: the smallest average depth of the sea, the largest maximum tide range, muddy water and wide area of muddy intertidal zones.

Lastly I prepared Table 8 to consider similarity of species composition between two of 4 regions. I calculated "a + b + c" according to the equation $a + b + c = B + C - a$, here B and C denote number of whole species occurring in each of the two regions. It can be seen that in the both anomuran and brachyuran cases the similarity between the Korea Strait and the Yellow Sea is highest, and the one between the Cheju I. waters and the Yellow Sea is lowest. Next-to-highest simirarity is the one between the Japan Sea and the Korea Strait in anomuran case; and the one between the Korea Strait and the Cheju I. waters, which is almost same as the one between the Japan Sea and the Korea Strait, in brachyuran case.

Kim and Kim (1982) calculated "Community coefficients" on 175 brachyuran species between two regions of every pair of four regions of Korean waters by the equation, $r = C/\sqrt{S_1 . S_2}$ (here, C: the number of common species which occurred in both corresponding regions simultaneously; S_1, S_2: the total number of species occurred in each region of the pair). Such coefficient is also an index of

Table 8. Numbers of species or subspecies common to both regions of every pair of 4 regions and similarity coefficients.*

		JS	KS	CI	YS
Anomura	JS		18	11	14
	KS	0.44(18/ 41)		14	18
	CI	0.23(11/ 48)	0.30(14/ 46)		8
	YS	0.39(14/ 36)	0.55(18/ 33)	0.20(8/ 43)	
Brachyura	JS		53	41	30
	KS	0.41(53/130)		67	72
	CI	0.33(41/125)	0.42(67/158)		29
	YS	0.28(30/106)	0.59(72/123)	0.19(29/149)	

* Jaccard's coefficient: r = a/a + b + c

a: the number of species common to both regions.

b and c: the number of species occuring in only one of the two regions.

similarity. Beside values calculated by Kim and Kim (1982) I calculated similarity coeffiecients (a/a + b + c) using their data for the comparison with the present data. The values are as follows, here the values before parenthesis are the ones by Kim and Kim (1982) and the values in parenthesis are the ones calculated by me:

JS-KS : 0.589 (0.384), JS-CI : 0.439 (0.275), JS-YS : 0.465 (0.300), KS-CI : 0.529 (0.356), KS-YS : 0.668 (0.480), CI-YS : 0.300 (0.176).

Here we can see the order (from the highest value to the lowest one) of 6 values of similarity coefficient in both cases (Kim and Kim, 1982 and present paper) is almost same, and all values of the present data except JS-YS : 0.28 increased. These increases seem to be due to the increases of collection sites and species numbers in each region.

In conclusion, these various features of occurrence and distributional aspects of the both of anomuran and brachyuran crabs in Korean waters seem to coincide well with the currents and the other evironmental conditions and also habits of these animals.

ABSTRACT

The anomuran species known from Korean waters are 57 species in 12 families: Axiidae (1 sp.), Laomediidae (1), Callianassidae (1), Upogebidae (1), Pomatochelidae (1), Diogenidae (12), Paguridae (19), Lithodidae (6), Chirostylidae (2), Galatheidae (4), Porcellanidae (7) and Albuneidae (2); and brachurans are 183 sp. in 20 families: Dromiidae (6), Tymolidae (1), Latreillidae (2), Raninidae (2), Dorippidae (2), Calappidae (9), Leucosiidae (12), Majidae (33), Hymenosomatidae (5), Parthenopidae (4), Atelecyclidae (4), Cancridae (3), Corystidae (1), Portunidae (16), Goneplacidae (5), Hexapodidae (1), Xanthidae (22), Grapsidae (29), Pinnotheridae (10) and Ocypodidae (16). The author divided the coastal waters of Korea into 4 regions: the Japan Sea (JS), the Korea Strait (KS), the Cheju Island

waters (CI), and the Yellow Sea (YS), dividing those animal species into 3 geographical distribution forms: northern form (N), temperate zone form (T) and southern form (S). The anomuran species consist of 9N, 40T and 8S; and brachyurans consist of 7N, 87T and 89S. In anomuran case 29 sp. (9N, 19T, 1S), 30 sp. (2N, 24T, 4S), 30 sp. (0N, 24T, 6S) and 21 sp. (2N, 17T, 2S) appeared in JS, KS, CI and YS respectively, and in brachyuran case 62 sp. (7N, 32T, 23S), 121 sp. (1N, 66T, 54S), 104 sp. (1N, 39T, 64S) and 74 sp. (1N, 46T, 27S) ditto. In anomuran case 8 sp. (6N, 2T, 0S), 3 sp. (0N, 2T, 1S), 16 sp. (0N, 12T, 4S) and none occurred in only JS. KS, CI and YS respectively. In brachyuran case 8 sp. (6N, 1T, 1S), 20 sp. (0N, 14T, 6S), 40 sp. (0N, 10T, 30S) and 12 sp. (0N, 9T, 3S) ditto. 7 of 57 anomuran species and 23 of 183 brachyuran ones were found in all 4 regions. Similarity coefficients of species composition between two of 4 regions were calculated. Environmental conditions of those regions were mentioned for understanding distributional aspects of the animals.

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